Vol. 38 No. 9

BULLETIN

OF THE

TORREY BOTANICAL CLUB

SEPTEMBER, 1911

Contributions to the Mesozoic flora of the Atlantic coastal plain—VII

EDWARD W. BERRY

(WITH PLATES 18 AND 19)

The present contribution is a continuation of the author's previous studies upon the Upper Cretaceous floras of the Atlantic coastal plain and embraces additions to these floras from various localities and horizons extending from Raritan Bay in New Jersey to the Savannah River.

THE FLORA OF THE MATAWAN FORMATION

A considerable flora from the region around Keyport, New Jersey, was described by the writer nearly ten years ago. At that time these beds were included by geologists in the Matawan formation, but they have since been discriminated as a separate unit as far to the southwestward as the Potomac River under the name of the Magothy formation. This latter formation embraces all of those leafbearing beds in New Jersey which had previously been considered a part of the lower Matawan formation, leaving the restricted Matawan, which consists of strictly marine deposits, without any known flora. For this reason considerable interest is attached to the discovery in marine deposits of this age of the following identifiable species.

Ficus matawanensis sp. nov.

DESCRIPTION: Leaf oblong-lanceolate in outline, about 14 cm. to 15 cm. in length by 3.5 cm. in maximum width. Petiole short

[The BULLETIN for August 1911 (**38**: 351–398. *pl. 16, 17*) was issued 21 Au 1911.]

and very stout. Midrib very stout, prominent on the lower side of the leaf. Margins rather straight. Apex missing. Base pointed, slightly decurrent. Secondaries numerous, thin, regularly spaced, branching from the midrib at angles of about 50 degrees, running in an almost straight course to the vicinity of the margin, where their ends are united by flat arches. Tertiary venation as in the modern *Ficus elastica* Thunb. Texture very coriaceous. (PLATE 19, FIG. 3.)

The present species is very closely related to *Ficus reticulata* (Lesq.) Knowlton,* a species described originally from the Dakota sandstone of Kansas and reported by the writer from the Magothy formation of New Jersey. There are, however, slight differences in outline and in the details of the venation, which make it desirable to institute a new species. It shows also considerable similarity with a new species of *Ficus* to be described shortly by the writer from the Upper Cretaceous of Buena Vista, Georgia. The material, which is scanty, was collected from the Lorillard pits in the Woodbury clays by Dr. H. P. Little, a former student at the Johns Hopkins University. It was contained in a carbonate of iron nodule, such as are common in the dark micaceous shallow water clays at this point.

In addition to the foregoing species of *Ficus*, fragmentary leaves have been observed in similar nodules in the Matawan formation at Penny Hill, Delaware, and the following species has recently been collected from this horizon in Maryland.

DAMMARA CLIFFWOODENSIS Hollick

Dammara cliffwoodensis Hollick, Trans. N. Y. Acad. Sci. **16**: 128. *pl. 11. f. 5–8.* 1897.

These characteristic deciduous cone scales were described from the Magothy formation of New Jersey, where they are abundant. They are very similar to the somewhat earlier *Dammara borealis* Heer and furnish evidence of the substantial unity in floral characters between the Magothy and Matawan formations. The present occurrence is based on materials associated with waterworn fragments of lignite and marine invertebrates, ¾ mile east of Millersville, Anne Arundel County, Maryland.

* This name is preoccupied by *Ficus reticulata* Saporta, 1863, an Oligocene species of southeastern France, as well as by the living *F. reticulata* Thunb. 1786.

THE FLORA OF THE MAGOTHY FORMATION

Numerous contributions to the flora of the Magothy formation in New Jersey, Delaware, and Maryland have been made by the writer during the past few years. The last of these, published early in 1910, brought the total number of Magothy species reported from Maryland up to seventy-one. The following notes enumerate some recent additions to this flora, bringing the total number of recorded forms up to eighty-eight.

Algites americana sp. nov.

DESCRIPTION: Thallus, as preserved in the form of dichotomously divided branches, ranging in width from 2 mm. to 5 mm., thin and undulating as preserved, but rather coriaceous in life, with slightly wavy margins. These branches are not preserved for lengths of more than a few centimeters, during which intervals they are observed to divide but once or not at all. They have the appearance in some specimens of radiating from a common center, but as their proximal parts are invariably missing this supposition cannot be verified.

The Maryland remains are rare and are in the form of impressions along which recent rootlets have often permeated the argillaceous matrix, sometimes giving the specimens the appearance of having midribs. The North Carolina remains, which are abundant in the Black Creek beds at certain localities along the Black River, often show considerable carbonaceous residuum, indicating that in life the thallus was of considerable consistency.

OCCURRENCE: Severn River, Anne Arundel County, Md.

COLLECTIONS: U. S. National Museum.

ONOCLEA INQUIRENDA (Hollick) Hollick

Osmunda obergiana Heer, Fl. Foss. Arct. 3^2: 98 (in part). *pl. 26. f. 9d.* 1874.

Caulinites inquirendus Hollick, Bull. N. Y. Bot. Gard. 3: 406. *pl. 70. f. 3.* 1904.

Onoclea inquirenda Hollick, Mon. U. S. Geol. Surv. **50**: 32. *pl. 1. f. 1–7.* 1907.

DESCRIPTION: Fragments of fertile fronds, not showing any lamina, which appears to be reduced to short pinnate branches bearing one or more spheroidal bodies interpreted as sori. These are uniformly 1.5 mm. or slightly less in diameter. (PLATE 18, FIG. 1, 1*a*.)

This species was originally described by Hollick (loc. cit.) and referred to the genus *Caulinites*, but was subsequently removed to the ferns because of its resemblance to the modern genus *Onoclea*, a resemblance that is close and not at all fanciful. Earlier figured forms of the same character were associated by Heer with his species *Osmunda obergiana* because they were found in the same beds with the fronds of this species although they were not found in organic union with the fronds. These fruits are much more like those of the modern forms of *Onoclea* than they are like those of *Osmunda*, and they are identical with those which are the type of the present species to which the writer has referred them.

The Long Island and Marthas Vineyard forms have these sori in a single row on each side of an axis, and some of the South Carolina specimens seem to have a similar arrangement, while others have them definitely in threes, one terminal and two lateral. This latter arrangement also prevails exclusively in the Greenland specimen and in similar material from the Magothy formation of Maryland. This variation is of minor importance and is mentioned simply because it is believed that the grouping in threes is the normal arrangement, which has been obscured during fossilization in the instances where it is not clear.

As here understood this species ranges from the Atane beds of Greenland southward in the Magothy formation of Marthas Vineyard, Long Island, and Maryland, to the Middendorf beds in South Carolina.

OCCURRENCE: Severn River, Anne Arundel County, Md.

GLEICHENIA SAUNDERSII Berry

Gleichenia Saundersii Berry, Amer. Nat. **37**: 679. *f. 1–3.* 1903.

This small-pinnuled and coriaceous form was described originally from the Magothy formation of New Jersey, where it is present both on Raritan Bay and along the Delaware River. It has been recently discovered in the Magothy formation of Maryland, where at times the pinnules are rounded as shown in FIG. 2. This species resembles *Gleichenia gracilis* Heer, differing in the more numerous veins and their habit of forking. (PLATE 18, FIG. 2, 3, 3*a*.)

OCCURRENCE: Severn River, Anne Arundel County, Md.

Asplenium cecilensis sp. nov.

DESCRIPTION: Complete frond unknown. Pinnules linear-lanceolate, falcate, subopposite, united to the stout rachis by their entire bases, with entire margins and acute tips. The sterile pinnules are somewhat smaller than the fertile, being about 12 mm. or 13 mm. in length by 3 mm. in maximum width, which is at their base. They show a stout midrib which gives off about twenty-five branches on each side alternately above and below and is lost in the apical region by this repeated branching. These branches subtend a considerable angle and are recurved; they fork once near their base and run directly to the margin. The fertile pinnules are somewhat larger than the sterile, being of about the same length and slightly wider; they show stout midribs and the poorly preserved remains of numerous linear-lanceolate sori extending nearly from the midrib to the margin and obscuring the lateral veins, there being apparently a sorus to each forked lateral. (PLATE 18, FIG. 4, 5.)

This species greatly resembles various forms from the Upper Cretaceous of Greenland, which Professor Heer referred to the genus *Pteris*, the resemblance to *Pteris Albertsii* Heer being particularly marked. The latter is usually referred to the genus *Cladophlebis*, and this genus contains a number of forms that are comparable with *Asplenium cecilensis*. The fertile pinnules of the latter, imperfect as is their preservation, are clearly unlike those known in *Cladophlebis* and are clearly of a type allying this form with the Asplenieae.

OCCURRENCE: Grove Point, Cecil County, Md.

PODOZAMITES KNOWLTONI Berry

Podozamites Knowltoni Berry, Bull. Torrey Club **36**: 247. 1909.

This well-known older Mesozoic species is common in the Upper Cretaceous of the coastal plain from New Jersey to South Carolina and also occurs in the Dakota sandstone of the West. It is present in recent collections from the Magothy formation in the vicinity of Round Bay on the Severn River in Anne Arundel County, Md.

Protophyllocladus lobatus sp. nov.

Thinnfeldia sp. nov., Berry, Johns Hopkins Univ. Circ. II. 7: 81. 1907.

DESCRIPTION: Leaves (phylloclads) of large size, lanceolate or oval in general outline, either entire with crenate margins, rounded

apex, and narrowly cuneate base or compound through the development of opposite lateral lobes. Axial vascular strand very stout below, becoming very thin and finally disappearing apically. When lobate, subordinate opposite vascular strands form the axis of the lobes, and these are usually but not always lost before reaching the tips of the lobes by giving off innumerable secondary branches. Margins are in all cases rather remotely undulate-crenate and the tips are all rounded. Secondaries numerous and thin, diverging from the main axis of the phylloclad on the axis of the lobes at very acute angles, curving outward, either simple, more often dichotomously forked, and occasionally several times forked. Lobes when present separated by cuneate narrowly rounded sinuses which terminate some distance from the main axis. The largest specimen, which is still incomplete at both the apex and the base, measures 8 cm. in length and 5 cm. from tip to tip of the lower lobes, the upper entire portion measuring about 1.5 cm. in width.

These remains are superficially like fern fronds, especially in specimens that are compound, and were it not for the presence in the Cretaceous of other *Phyllocladus*-like remains with a demonstrated gymnospermous structure (e. g., *Androvettia*) their reference to this genus would seem hazardous. The entire specimens are strikingly like some of the forms of *Protophyllocladus subintegrifolius* (Lesq.) Berry of the Raritan and Magothy formations, or like *Protophyllocladus polymorphus* (Lesq.) Berry from higher western American horizons, and even the compound specimens have an unlobed apical portion of comparable length which is also similar in appearance to the two species just mentioned. The compound forms are superficially like *Thinnfeldia rhomboidalis* Ettings.,* the type of the genus *Thinnfeldia*, whose systematic position has been the occasion of so much controversy and which has been variously regarded as a fern, a cycad, or a conifer. The present species shows important differences, however, aside from its much younger age, and it is confidently believed to be unrelated to the various older Mesozoic species of *Thinnfeldia* that have been described.

It may also be compared with various forms from the Upper Cretaceous of Dalmatia which were discussed at great length by Kerner,† who refers them to the genus *Pachypteris*. This he

*Ettings. Abhl. Geol. Reichsanstalt **3**: 2. *pl. i. f. 4–7.* 1852.

†Kerner, Jahrb. Geol. Reichsanstalt **45**: 39. 1896.

regards as cycadaceous in nature, but it is believed to be closest to *Protophyllocladus subintegrifolius*, a species that is abundant in the Atane beds of Greenland, the Dakota group of Kansas and Nebraska, the Raritan of New Jersey, and the Magothy from Marthas Vineyard to New Jersey, and which often assumes a sublobate form. This is especially shown in unreported collections made by the writer in the Magothy formation of New Jersey.

The present species is found in the Magothy formation of Maryland and is frequent in the Middendorf beds of South Carolina. The latter occurrences will be fully described and illustrated in a forthcoming report of the U. S. Geological Survey.

OCCURRENCE: Sullivans Cove, Severn River, Anne Arundel County, Md.

(?) ARAUCARIA BLADENENSIS Berry

Araucaria bladenensis Berry, Bull. Torrey Club **35**: 225. *pl. 12–14. f. 1–3.* 1908.

This species is highly characteristic of the Black Creek and lower Eutaw horizons of the southern coastal plain and is very abundant in North Carolina and along the Chattahoochee River in Georgia, occurring also in central Alabama. It is represented in the Magothy formation of New Jersey by *Araucarites ovatus* Hollick. There is a single well marked leaf of an *Araucaria* in the collections from Grove Point, Cecil County, Maryland, which is very close to *Araucaria bladenensis*, but which I have queried since the material is so scanty that it might possibly represent a small leaf of the normally larger *Araucarites ovatus*.

Sabalites magothiensis (Berry) nom. nov.

Flabellaria magothiensis Berry, Torreya **5**: 32. *f. 1, 2.* 1905.

Since the name *Flabellaria* as the designation of a genus of fossil palms (Sternberg, 1820) is preoccupied by Cavanille's monotypic recent genus *Flabellaria* of the family Malpighiaceae, described in 1790, this species is referred to the form genus *Sabalites*, which is an equally appropriate repository for flabellate, Sabal-like, fossil palm leaves of uncertain botanical affinities.

PISTIA NORDENSKIOLDI (Heer) Berry

Pistia Nordenskioldi Berry, Bull. Torrey Club **37**: 189. *pl. 21. f. 1–15.* 1910.

This well marked type, which was described originally by Professor Heer from the Atane beds of Greenland as a species of *Chondrophyllum*, and which was found to be exceedingly common in the Black Creek beds of North Carolina, is present in the Magothy formation at Grove Point, Cecil County, Md.

Doryanthites cretacea gen. et sp. nov.

Leaves, as preserved, linear, presumably lanceolate above and sheathing below, alike on both surfaces, 4.5 cm. to 6 cm. wide and preserved without any diminution in width for a length of 50 cm. Texture very coriaceous. Margins entire. Veins simple and parallel, immersed, less than 1 mm. apart. Stomata poorly preserved, in rows in hollows between the veins.

These curious forms, which will be more fully characterized and figured in monographs on the North Carolina and Georgia floras now in course of publication, call to mind the larger forms of *Cordaites* or some modern giant bromeliad. They are monocotyledons of unknown botanical affinity, and the name chosen is based upon their similarity with the modern genus *Doryanthes* of the Liliales and is without any significance of relationship.

The present species is abundant and characteristic in the Black Creek formation of North Carolina, the Cusseta sands of Georgia, and the lower Eutaw of Alabama. It is probably represented in the Magothy formation of New Jersey by the forms from Cliffwood bluff which have been identified as *Podozamites marginatus* Heer. In the Maryland Magothy *Doryanthites cretacea* occurs at Sullivans Cove and other adjacent localities along the Severn River in Anne Arundel County.

MAGNOLIA CAPELLINII Heer

Magnolia Capellinii Heer, Phyll. Crét. Nebr. 21. *pl. 3. f. 5, 6.* 1866.

This well-known species, which characterizes the Magothy formation of the northern coastal plain, the Black Creek beds of North Carolina, and the Tuscaloosa formation of Alabama, occurs in the Magothy formation of Maryland at Grove Point in Cecil County, and at Sullivans Cove on the Severn River in Anne Arundel County.

COLUTEA PRIMORDIALIS Heer

Colutea primordialis Heer, Fl. Foss. Arct. 6²: 99. *pl. 27. f. 7–11; pl. 43. f. 7, 8.* 1882.

This well marked little species was described from the Atane beds of Greenland. It occurs in strata at least as old as the upper Raritan in New Jersey and is present in both the Dakota and Magothy floras. It is present in the collections from Grove Point, Cecil County, Maryland, where it is associated with *Colutea obovata* Berry.

Dalbergia severnensis sp. nov.

DESCRIPTION: Leaves of rather small size, oblanceolate in general outline, with a markedly emarginate apex, gently curved sides, and narrowly pointed base. Length about 5 cm. Maximum width about 1.5 cm. in the middle part of the leaf. Midrib stout below, thin above. Secondaries five or six pairs, branching from the midrib at angles of 45 degrees or less, the lower ascending, the upper curved, all eventually camptodrome.

This handsome form, which is clearly distinct from any previously described species, is identical in its characters with the forms usually referred to *Dalbergia*. (PLATE 19, FIG. 2.)

OCCURRENCE: Little Round Bay, Severn River, Anne Arundel County, Md.

Ilex severnensis sp. nov.

DESCRIPTION: Leaves of small size, oblong in general outline, with a cuspidate apex and a narrowly rounded base. Length about 2 cm. Maximum width about 6.5 mm. Texture coriaceous. Margin entire below; above, with a few irregularly spaced salient serrate teeth. Midrib relatively stout. Secondary venation thin and more or less obsolete, consisting of a vein which forms a marginal hem all around and numerous transverse veins between it and the midrib. The latter are for the most part nearly straight, diverging from the midrib at angles of about 90 degrees, giving the leaf a scalariform appearance, as shown in the enlarged figure of this form. (PLATE 19, FIG. 1, 1*a*.)

This small species is clearly new and is closely allied to various species of *Ilex*.

OCCURRENCE: Little Round Bay, Severn River, Anne Arundel County, Md.

CELASTRUS ARCTICA Heer

Celastrus arctica Heer, Fl. Foss. Arct. 7: 40. *pl. 61. f. 5d, e.* 1883.

This extremely well marked species was described by Heer

from the Patoot beds of Greenland. It was subsequently found to be exceedingly abundant in the uppermost Raritan beds of New Jersey* and it has been recorded from this same horizon on Long Island as well as from a probable Magothy horizon on Block Island. It has been recently found in considerable abundance near the top of the Magothy formation at Little Round Bay on the Severn River in Anne Arundel County, Md.

ARALIA GROENLANDICA Heer

Aralia groenlandica Heer, Fl. Foss. Arct. **6**[2]: 84. *pl. 38. f. 3; pl. 39. f. 1; pl. 46. f. 16, 17.* 1882.

This somewhat poorly defined species of the Atane, Dakota, and Magothy formations is present in the collections from Sullivans Cove on the Severn River in Anne Arundel County, Md.

Cornus cecilensis sp. nov.

DESCRIPTION: Leaves of medium size, broadly ovate in outline, 8.5 cm. in length by 4.75 cm. in maximum width at a point about halfway between the apex and the base. Apex bluntly pointed. Base cuneate. Midrib stout. Secondaries about six pairs, branching from the midrib at angles of about 45 degrees, curving upward approximately parallel with the margin, at length camptodrome. (PLATE 19, FIG. 4.)

This new species is broader and more elliptical in outline than any previously known Cretaceous species of *Cornus*. It is contained in collections from Grove Point in Cecil County, Md.

MYRSINE GAUDINI (Lesq.) Berry

Myrsine Gaudini Berry, Bull. Torrey Club **36**: 262. 1909.

This species has been recorded from a number of widely scattered areas in the Raritan, Magothy, Black Creek, and Tuscaloosa floras of the coastal plain from Long Island to Alabama, and also from the Dakota sandstone of Kansas. The present occurrence is at Grove Point in Cecil County, Md.

THE RARITAN FLORA OF MARYLAND

No fossil plants have been specifically recorded from the Raritan formation in the state of Maryland although this horizon

*Newberry, Fl. Amboy Clays 98. *pl. 13. f. 8–18.* 1896.

has yielded a large and diverse flora in New Jersey, the bulk of which comes from the clay beds of the Amboy district in Middlesex County.

In Maryland the Raritan is much more sandy than to the northeastward, and while fragments of vegetation are widely distributed, identifiable remains are rare and extremely local. From a locality in the District of Columbia known as Pennsylvania Avenue extended, which has the same outcrop as that referred to in the present paper as East Washington Heights, the following forms have been enumerated: *Aralia washingtoniana* Berry, *Platanus Heerii* Lesq., *Salix Lesquereuxii* Berry, *Sassafras acutilobum* Lesq., and *Sassafras cretaceum* Newb. These were recorded in a previous paper devoted to the flora of the Magothy formation,* to which horizon they were referred. Upon examination this outcrop proves to be in the Raritan formation, and several additional species have been discovered from it.

ASPLENIUM DICKSONIANUM Heer

Asplenium Dicksonianum Heer, Fl. Foss. Arct. 3^2: 31. *pl. 1. f. 1–5.* 1874.

This late Lower and early Upper Cretaceous fern has been recorded from a variety of horizons and localities and has no doubt been confused with other fern genera, as for example *Onychiopsis* (*Thyrsopteris* of Fontaine). It is abundant in the New Jersey Raritan,† and forms identical with the New Jersey material are present at Shannon Hill in Cecil County, Maryland, and at East Washington Heights in the District of Columbia.

Cladophlebis socialis (Heer)

Pecopteris socialis Heer, Fl. Foss. Arct. 6^2: *pl. 7. f. 4; pl. 8. f. 15; pl. 32. f. 9.* 1882 (not Fontaine).

The present species was described by Professor Heer from the Atane beds of western Greenland. Subsequently Fontaine identified as this species a very different form from the Patapsco formation of Virginia, a form that I have referred to *Cladophlebis Browniana* (Dunker) Seward.

Remains identical with Heer's type, which I refer to the form

* Berry, Bull. Torrey Club **37**: 19–29. 1910.

† Newberry, Fl. Amboy Clays 39. *pl. 1. f. 6, 7; pl. 2. f. 1–8; pl. 3. f. 3.* 1896.

genus *Cladophlebis*, are contained in the Raritan material from Shannon Hill, Cecil County, Md.

PODOZAMITES LANCEOLATUS (L. & H.) F. Braun

Podozamites lanceolatus F. Braun in Münster, Beitr. Petrefaktenkunde **2**: 33. 1843.

This possibly composite species, which has a recorded range from the Jurassic to the Upper Cretaceous, occurs in the Raritan collections from Shannon Hill, Cecil County, Md. It is present in the underlying Patapsco formation and in the overlying Magothy formation in the Maryland area and is of slight stratigraphic significance.

PODOZAMITES MARGINATUS Heer

Podozamites marginatus Heer, Fl. Foss. Arct. **6**^{2}: 43. *pl. 16. f. 10.* 1882.

The type of this species was described by Heer from the Atane beds of western Greenland. Subsequently Newberry* reported abundant fragmentary remains of this species from the middle Raritan deposits of New Jersey. The writer has recorded it from the Magothy formation of New Jersey but this identification is probably erroneous.

What appear to be leaflets of this species are present in collections from the Raritan formation of Maryland at the locality on the Drum Point R. R. near the head of the Severn River in Anne Arundel County.

FICUS OVATIFOLIA Berry

Ficus ovata Newb., Mon. U. S. Geol. Surv. **26**: 70. *pl. 24. f. 1–3.* 1896 (not Don, 1803).

Ficus ovatifolia Berry, Bull. Torrey Club **36**: 253. 1909.

This species, which is close to and probably the ancestral form of *Ficus Woolsoni* Newb., is sparingly represented in the Raritan formation at East Washington Heights, District of Columbia.

ASPIDIOPHYLLUM TRILOBATUM Lesq.

Aspidiophyllum trilobatum Lesq. Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1874**: 361. *pl. 2. f. 1, 2.* 1876.

* Newberry, Fl. Amboy Clays 44. *pl. 13. f. 5, 6.* 1896.

This remarkable species was described from the Dakota sandstone of Kansas, to which horizon it has hitherto been confined. It is present at a number of Maryland Raritan localities in considerable abundance although for the most part in a rather fragmentary condition.

OCCURRENCE: Shannon Hill, Cecil County; Riverside Brick Co., Anne Arundel County; East Washington Heights, District of Columbia.

PROTOPHYLLUM MULTINERVE Lesq.

Protophyllum multinerve Lesq. Fl. Dakota Group 191. *pl. 43. f. 2; pl. 65. f. 1.* 1892.

This species was described from the Dakota sandstone in 1872 as a species of *Pterospermites.** It has not been hitherto recorded outside of this horizon in Kansas. It is common in the Raritan clays at Cedar Point in Baltimore County, and less abundantly represented at East Washington Heights, District of Columbia.

PROTOPHYLLUM STERNBERGII Lesq.

Protophyllum Sternbergii Lesq. Fl. Dakota Group 189. *pl. 142. f. 1.* 1892.

This species, like the preceding, has not heretofore been found outside the Dakota sandstone of the West, from which it was described originally as a species of *Pterospermites.*† It is found to be not uncommon in the Maryland Raritan and is represented in collections from Shannon Hill and Bull Mountain in Cecil County, and from East Washington Heights in the District of Columbia.

PLATANUS HEERII Lesq.

Platanus Heerii Lesq. Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1871**: 303. 1872 (not Ward).

Sassafras recurvatus Lesq. Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1872**: 424. 1873 (not Heer 1882).

Platanus Heerii Lesq. Cret. Fl. 70. *pl. 8. f. 4; pl. 9. f. 1, 2.* 1874.

Platanus recurvata Lesq. ibid. 71. *pl. 10. f. 4, 5.* (not *f. 3*).

---

*Lesq. Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1871**: 302. 1872.

†Lesq. Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1872**: 425. 1873.

(?) *Platanus Heerii* Lesq. Rept. on Clays in N. J. 29. 1878.
Platanus Heerii Heer, Fl. Foss. Arct. 6^2: 72. *pl. 7. f. 1, 2; pl. 8. f. 1, 2a; pl. 9. f. 1–4.* 1882.
(?) *Platanus Heerii* Lesq. Cret. and Tert. Fl. 44. *pl. 3. f. 1; pl. 7. f. 5.* 1883.
Sassafras (Araliopsis) recurvatum Lesq. ibid. 57 (part). 1883.
Sassafras cretaceum recurvatum Berry, Bot. Gaz. **34**: 438. 1902.
Platanus Heerii Berry, Bull. Torrey Club **37**: 23. 1910.

DESCRIPTION: Leaves broadly rhomboidal in outline, more or less trilobate. Lobes, when developed, short and obtuse. Base decurrent. Petiole long and stout. Margin sublobate, undulate or irregularly dentate. Texture coriaceous. Primaries three, stout, diverging at acute angles. The lateral primaries are as stout as the midrib from which they branch in an opposite or subopposite position, either from the extreme base or a considerable distance above the base. In the latter case there is often a prominent secondary given off from the midrib on either side below the primaries. The primaries may give off a few rather long straight craspedodrome secondaries to the rather full lateral margin or they may send off a stout lateral branch at varying distances above the base. Secondaries from the midrib few in number, stout, irregularly spaced, craspedodrome. Tertiaries transverse, platanoid.

This species was described from the Dakota sandstone of Kansas by Professor Lesquereux, in 1872, who subsequently in his Cretaceous Flora confused it with *Platanus* or *Sassafras recurvatum*. The latter, if it really designates a species, must be restricted to the form figured by Lesquereux on *plate 10, fig. 3* of the Cretaceous Flora, which is decidedly different from his other figures on that plate. The latter are leaves of *Platanus Heerii* while the former must be referred to *Sassafras cretaceum* or *mirabile*. Not only is it distinctly trilobate but the margin is entire and the venation camptodrome, while in the leaves of *Platanus Heerii* on the same plate the form and margin are different and the venation is craspedodrome. Professor Heer correctly identified *Platanus Heerii* from the Atane beds of Greenland, and the forms which he figured from these beds as *Sassafras recurvatum* are distinct from *Platanus Heerii* and resemble Lesquereux's *fig. 3* mentioned above. The writer, some years ago (1902, loc. cit.) in discussing *Sassafras recurvatum*, pointed out the composite nature of this form and

suggested that those forms which are here referred to *Platanus Heerii* were referable to *Platanus*, while the other type was comparable with *Sassafras cretaceum* or *mirabile*.

Professor Ward, in 1887,* after sending figures of some leaves which he had collected at Black Buttes, Wyoming (a probably basal Eocene locality), to Lesquereux, who insisted that they were not *Platanus Heerii*, persisted in identifying them as this species although they are obviously not closely related to it.

Platanus Heerii was identified by Lesquereux from the New Jersey Raritan in collections made from Pettit's pits, South River, but as the material was poor and the species has not since been detected in the New Jersey Raritan this occurrence is usually ignored, although the abundance of this species in the Raritan of Maryland renders its presence in New Jersey probable. In the Maryland Raritan, fragments of this species are very common but they are usually in a bad state of preservation. The species extends northward to the west coast of Greenland and it shows considerable resemblance to *Credneria rhomboidea*, described by Velenovsky from the Cenomanian of Bohemia.†

OCCURRENCE: Drum Point R. R. near head of Severn River, Anne Arundel County, Md.; East Washington Heights, District of Columbia.

COLLECTIONS: Maryland Geological Survey, U. S. National Museum.

Araliopsis gen. nov.

The name *Araliopsis* was used by Professor Lesquereux as the designation for a group of forms which he described under *Sassafras*.

Since these species are not allied to *Sassafras* and show numerous characters that ally them with the Araliaceae their segregation is warranted. *Araliopsis* becomes, then, a form genus for certain araliaceous leaves that cannot be identified with any of the known genera with any degree of certainty.

Araliopsis cretacea (Newberry)

Sassafras cretaceum Newb. Ann. N. Y. Lyc. Nat. Hist. **9**: 14. 1868 (not Penhallow, 1904 and 1908). Ill. Cret. and Tert.

* Ward, Bull. U. S. Geol. Surv. 37: 34. *pl. 15. f. 3, 4.* 1887.

† Velenovsky, Fl. Böhm. Kreidef. 1: 11. *pl. 3. f. 2, 3: pl. 4. f. 1.* 1882.

Pl. *pl. 6. f. 1–4.* 1878. Mon. U. S. Geol. Surv. **35**: 98. *pl. 6. f. 1–4; pl. 8. f. 1, 2* (not *pl. 7. f. 1–3*). 1898. Lesquereux, Cret. Fl. 80. *pl. 11. f. 1, 2; pl. 12. f. 2.* 1878. ?Kurtz, Revista Mus. La Plata **10**. 1902. Berry, Bot. Gaz. **34**: 444. 1902.

DESCRIPTION: "Leaves petiolate, decurrent at base, very smooth above, strongly nerved below; three-lobed; lobes entire and acute. The nervation is all strongly defined; the central nerve straight or nearly so; the lateral primary nerves springing straight outward till they approach the margin of the lobes, when they are abruptly curved and run together. From these the tertiary nerves are given off at a right angle, and from these the quaternary nerves spring at a similar angle, together forming a network of which the areoles are subquadrate." Newberry, 1868.

Professor Newberry includes under *Sassafras cretaceum* the various forms described by Professor Lesquereux as *S. Mudgei*, *S. subintegrifolium*, *S. integrifolium*, *S. obtusum*, *S. cretaceum dentatum*, *S. cretaceum obtusum*, *S. acutilobum*, *Cissites Harkerianus*, and *C. salisburiaefolius*. While this shows the undoubted composite nature of *S. cretaceum*, it shows also that the extremes of leaf form above mentioned are so closely connected with the more typical leaf by a series of intermediate forms that the question of where one species shall end and another begin is an extremely difficult one.

The writer considers the leaf figured on *pl. 6. fig. 1*, Later Ext. Fl., to be the typical form of this species, thus agreeing with Newberry's original description and with his later opinion expressed in 1898. This type bears considerable resemblance to some modern *Sassafras* leaves. A slight widening of the terminal lobe of some of these in the basal region would give a leaf strikingly like *S. cretaceum;* or, were the sinuses of the latter slightly deeper we would have the typical modern leaf. The basal portion of the leaf is like *Sassafras*, and the indications point to a similar venation in this region. The first pair of secondaries do not branch to form margins of the sinuses; the left one runs directly to the sinus, however, and may possibly have conformed to the margin and been effaced in the specimen; the right one is stronger and runs almost to the sinus, where it makes a sharp turn upward, continuing until it joins the next secondary. This feature is

analogous to those in the modern leaf, which may indicate the mode of origin of this peculiar character. This leaf seems to form a central figure from which a series of forms grade in several directions, culminating in quite dissimilar leaves. Lesquereux's *S. cretaceum* is a more Platanoid leaf, with more acute tips, a tendency to become dentate, and with the primaries inserted nearer the base. Closely allied to the preceding is his *S.* (*Araliopsis*) *mirabile*, which serves as a connecting link with his *Platanus recurvata*. From the aforementioned *S. cretaceum* of Lesquereux it is but a step to such a leaf as the one shown on *pl. 8. fig. 2*, Later Ext. Fl., and to the trilobed forms referred to *Cissites Harkerianus*, and these in turn grade into the more Cissoid forms of this species, such as those shown on *pl. 11. fig. 3*, Cret. Fl. The primaries are basal and of not much greater caliber than the regularly succeeding straight secondaries. It is but a step from this leaf to that of *Cissites Heerii* on the one hand, with its palmately five-pointed blade; and to such forms as *Cissites acuminatus*, *pl. 5*, *fig. 4*, Cret. and Tert. Fl., on the other; which in turn, by the elimination of the decreasing dentate points, gives us the leaf figured as *3*, *pl. 5*, Cret. and Tert. Fl. In the second series of leaves diverging from the typical, *S. cretaceum*, *pl. 8*, *fig. 1*, Later Ext. Fl., is removed a slight distance by the shortening of the blade, the thickening of the primaries and secondaries, and the shortening and rounding of the lobes (*S. obtusum*); while a smaller leaf would be its logical descendant; and from these leaves to those referred to the typical *Cissites salisburiaefolius* is but a step. In the third series of leaves diverging from the typical *S. cretaceum*, we note that the leaf has its lobes much produced, narrow and running to a sharp point, as in the beautiful leaf on *pl. 7. fig. 1*, Later Ext. Fl., which however is still referred to *S. cretaceum*. Lesquereux's *S. acutilobum* does not differ greatly from the preceding except in the direction of the lobes, which is a questionable specific character. From this leaf there is no great jump to those trilobed forms which are referred to *Aralia Wellingtoniana*, the chief difference being in the margin. Thus we have an interrelated series connecting those leaves which seem to show affinity to *Sassafras* with those which suggest *Platanus*, and with others that suggest *Cissites* and *Aralia*.

While it may be considered probable that from a biologic viewpoint the forms mentioned in the foregoing paragraphs, as well as others not cited, represent the variations of a single species of Upper Cretaceous tree, or at least represent the leaves of closely affiliated species, it seems best from the viewpoint of systematic, and especially stratigraphic, paleobotany, that most of the differentiations instituted by Lesquereux be perpetuated. Consequently the present species is limited to the typical material as defined and illustrated by the original describer.

Falling within these limits are a number of unrecorded specimens occurring in the Raritan formation of Maryland.

OCCURRENCE: Bull Mountain and Shannon Hill, Cecil County, Md.; East Washington Heights, District of Columbia.

COLLECTIONS: Maryland Geological Survey, U. S. National Museum.

Araliopsis cretacea dentata (Lesq.)

Sassafras (Araliopsis) cretaceum dentatum Lesq. Ann. Rept. U. S. Geol. and Geogr. Surv. Terr. **1874**: 344. 1876. Cret. Fl. *pl. 11. f. 1, 2.*

DESCRIPTION: This variety may be distinguished from the type by its usually smaller size and by its dentate margin.

OCCURRENCE: A characteristic specimen is present in the collections from the Raritan formation at Bull Mountain, Cecil County, Md.

Araliopsis cretacea salisburiaefolia (Lesq.)

Populites salisburiaefolia Lesq. Amer. Jour. Sci. II. **46**: 94. 1868.

Sassafras obtusus Lesq. Fifth Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1871**: 303. 1872.

Sassafras obtusus Lesq. Sixth Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1872**: 424. 1873.

Sassafras obtusum Lesq. Cret. Fl. 81. *pl. 13. f. 2–4.* 1874.

Sassafras (Araliopsis) cretaceum obtusum Lesq. Cret. Fl. 80. *pl. 12. f. 3; pl. 13. f. 1.* 1874. Mon. U. S. Geol. Surv. **17**: 102. 1892.

Cissites obtusum Lesq. Eighth Ann. Rept. U. S. Geol. Surv. Terr. (Hayden) **1874**: 354. 1876.

Sassafras (Araliopsis) obtusum Lesq. Cret. and Tert. Fl. 56. 1883.

Cissites salisburiaefolius Lesq. Cret. and Tert. Fl. 66. 1883.

Cissites salisburiaefolius Lesq. Mon. U. S. Geol. Surv. **17**: 164. 1892.

(?) *Sassafras cretaceum* Newb. Mon. U. S. Geol. Surv. **35**: *pl. 8. f. 1.* 1898.

Cissites salisburiaefolius Ward, Nineteenth Ann. Rept. U. S. Geol. Surv. Pt. 2: 707. *pl. 171. f. 5.* 1899.

Typical specimens of this well marked and handsome variety, which is possibly a distinct species, are common in the Raritan formation at Bull Mountain, Cecil County, Md.

Araliopsis breviloba sp. nov.

DESCRIPTION: Leaves of medium size, fanshaped in general outline, between 10 cm. and 11 cm. in length by the same dimensions in maximum width, which is from tip to tip of the lateral lobes. Trilobate. Apical lobe very short and conical. Lateral lobes short and pointed, somewhat recurved outward. Sinuses open, shallow and rounded, not extending more than one fifth of the distance from the apex to the base. Lateral margins at first full and rounded, then curving inward to the decurrent base. Primaries three in number, all equally stout and curved, the laterals subopposite and suprabasilar. Secondaries numerous, curved, camptodrome, branching from the primaries at angles of less than 45 degrees. Tertiaries transverse. Margins entire throughout. Texture coriaceous.

This characteristic leaf is probably the end term of a series of forms starting with *Araliopsis cretacea*, but whether it represents an extreme of variation of that species or a distinct but related species cannot now be definitely determined. The present form suggests various species from the Dakota sandstone of the West, which Professor Lesquereux referred to the genus *Cissites*. It is also similar to the form from the Cenomanian of Bohemia described by Velenovsky* as *Aralia anisiloba*, differing slightly in outline and lacking the remotely dentate margins of the latter.

OCCURRENCE: Bull Mountain, Cecil County, Md.

COLLECTIONS: Maryland Geological Survey.

DIOSPYROS PRIMAEVA Heer

Diospyros primaeva Heer, Phyll. Crét. Nebr. 19. *pl. 1. f. 6, 7.* 1866.

This well characterized species was described from the Dakota

*Velenovsky, Fl. Böhm. Kreidef. 1: 22. *pl. 5. f. 4–6.* 1882.

sandstone in 1866 by Professor Heer. It was subsequently detected in western Greenland by the same author and has been found to be abundant in the coastal plain from Marthas Vineyard to Texas. It is especially abundant in the upper Raritan at South Amboy, New Jersey, and is found in the Maryland Raritan at Bull Mountain in Cecil County.

Diospyros vera sp. nov.

DESCRIPTION: Calyx small, four-parted, 11.5 mm. in diameter from tip to tip of the lobes, which are obtusely pointed and nearly orbicular in outline, about 4 mm. or 5 mm. in width, contracted proximad and somewhat reflexed, coriaceous, longitudinally veined, with inflexed margins, which gives them a spoonlike form. Sinuses rather narrow and pointed, extending two thirds of the distance to the peduncle. The central disk of the calyx appears flat. There is a raised collar at the insertion of the peduncle, the latter from its scar appearing to have been relatively slender. (PLATE 19, FIG. 5.)

The present species is based upon the single specimen figured, which shows the lower, peduncular face of the calyx. It is clearly referable to this genus and the calyx was probably accrescent as in the modern forms. It is much smaller than in our common American *Diospyros virginiana* L., but may be matched in some of the still existing species and is almost the exact counterpart of some of the calices of *Diospyros brachysepala* A. Br., figured by Heer from the Swiss Tertiary. There can be no question regarding its identity and in this respect it is much more conclusive than the *Calycites diospyriformis* described by Newberry from the middle Raritan of New Jersey, which has a five-lobed calyx. Its occurrence at the same horizon in which the leaves of *Diospyros primaeva* Heer are so abundant not only suggests that it may have been borne by the same tree that furnishes the leaves found all the way from western Greenland to Alabama, but also serves in a measure to corroborate the identification of these leaves.

The family Ebenaceae has only five modern genera but these include a large number of species, a majority of which are referred to the genus *Diospyros*. The latter has about 180 existing species distributed in both hemispheres. They are mostly tropical, a few species extending beyond the tropics in eastern North America,

the Mediterranean region of Eurasia, and in eastern Asia, where there is a considerable massing of forms.

OCCURRENCE: East Washington Heights, District of Columbia.

COLLECTIONS: U. S. National Museum.

UPPER CRETACEOUS FLORA OF SOUTH CAROLINA*

Although several localities in the State of South Carolina are mentioned in Vanuxem's paper† announcing the presence of deposits of Cretaceous age in North America, these were all marine fossiliferous beds, and no deposits of this age are mentioned in Prof. Lester F. Ward's exhaustive paper on The Geographical Distribution of Fossil Plants, published in 1889. That fossil plants were not entirely unknown, however, is shown by the mention of several localities in Tuomey's Geology of South Carolina, published in 1848. In recent years Mr. Earle Sloan, State Geologist of South Carolina, has discovered several plant-bearing outcrops, and during the progress of the work upon which the following notes are based various collections have been made by the latter as well as by Dr. L. W. Stephenson and the writer. Collections were also made by Professors L. F. Ward and L. C. Glenn in 1897, and these also have been studied by the writer.

The Upper Cretaceous of South Carolina, which is the only known leaf-bearing Cretaceous, overlies unconformably the Lower Cretaceous, which forms a belt of varying width extending entirely across the state along the southeastern border of the Piedmont Plateau. These Upper Cretaceous deposits assume two more or less distinct lithological phases, in part contemporaneous, and dependent for the most part upon the physical conditions accompanying their deposition. The initial Upper Cretaceous deposition has been termed the Middendorf member and includes the littoral, estuarine, and shallow water phase of deposition at the commencement of the transgression of the Upper Cretaceous sea. These soon pass gradually into deeper but still shallow water deposits of sands and dark carbonaceous laminated clays, which have received the name of Black Creek beds. The latter are especially well developed in the northeastern part of the coastal plain of

* Published by permission of the Director of the U. S. Geological Survey.

† Vanuxem, L. Jour. Acad. Nat. Sci. Phila. **6**: 59-71. 1829.

South Carolina, being replaced to the southwestward by sands and kaolins marking a continuance of the Middendorf phase for a much longer time in that area than to the northeastward. Both phases finally pass gradually into typical marine, non-plant-bearing beds. Eleven localities within the state are known to bear fossil plants. Five of these are in the Middendorf and six are in the Black Creek, and these will be fully described in the final report on this flora.

Seventy-six different species of fossil plants have been determined from these various outcrops. Twenty-four of these are new to science. The latter are referred to the following genera:

Acaciaphyllites
Algites
Andromeda
Araucaria
Calycites
Celastrophyllum
Cinnamomum
Crotonophyllum
Ficus
Heterolepis
Illicium
Leguminosites
*Lycopodium**
Momisia
? *Pachistima*
Potamogeton
Proteoides
Protophyllocladus
Quercus (2 species)
Rhus
Salix
Strobilites

The following heretofore described species have been identified in the South Carolina collections:

Andromeda grandifolia Berry
Andromeda Novae-caesareae Hollick
Andromeda Parlatorii Heer
Araucaria bladenensis Berry
Araucaria Jeffreyi Berry
(?) *Arundo groenlandica* Heer
Brachyphyllum macrocarpum Newb.
Carex Clarkii Berry
Celastrophyllum crenatum Heer
Celastrophyllum elegans Berry
Cephalotaxospermum carolinianum Berry
Cinnamomum Newberryi Berry
Citrophyllum aligerum (Lesq.) Berry
Dewalquea Smithi Berry
Diospyros primaeva Heer
Diospyros rotundifolia Lesq.
Juglans arctica Heer
Laurus atanensis Berry† nom. nov.
Laurus plutonia Heer
Laurophyllum elegans Hollick
Laurophyllum nervillosum Hollick
Leguminosites robiniifolia Berry
Magnolia Capellinii Heer
(?) *Magnolia Newberryi* Berry
Magnolia obtusata Heer
(?) *Magnolia tenuifolia* Lesq.
Moriconia americana Berry
Myrica Brittoniana Berry
Myrica elegans Berry
Myrsine Gaudini (Lesq.) Berry
Onoclea inquirenda Hollick
Phragmites Pratti Berry

* This species is described in Amer. Jour. Sci. IV. **30**: 275, 276. 1910.

† This is a new name proposed for the well-known species *Laurus angusta* of Heer, preoccupied by a recent species proposed by Rafinesque.

Eucalyptus angusta Velenovsky
Eucalyptus Geinitzi Heer
Eucalyptus Wardiana Berry
Ficus atavina Heer
Ficus crassipes Heer
Ficus Krausiana Heer
Ficus Stephensoni Berry
Hamamelites (?) *cordatus* Lesq.
Hedera primordialis Saporta
Pinus raritanensis Berry
Podozamites Knowltoni Berry
Proteoides lancifolius Heer
Salix flexuosa Newb.
Salix Lesquereuxii Berry
Salix pseudo-Hayei Berry
Sapindus Morrisoni Heer
Sequoia Reichenbachii (Gein.) Heer
Widdringtonites subtilis Heer

These 76 species include one thallophyte, two pteridophytes, one cycadophyte, thirteen Coniferales, five Monocotyledones, and fifty-four Dicotyledones. They are distributed among forty-nine genera in thirty-six families and twenty-six orders. The largest orders are the Pinales, Urticales, Ranales, Thymeleales, and Sapindales, each of which has six species. The largest single genus is *Ficus* with five species and the species of this genus are also the most abundant individually. The genera *Salix*, *Magnolia*, and *Andromeda* have four species each; *Araucaria*, *Celastrophyllum*, and *Eucalyptus* have three each; and the following genera are represented by two species each: *Myrica*, *Quercus*, *Proteoides*, *Leguminosites*, *Laurus*, *Laurophyllum*, *Cinnamomum*, and *Diospyros*.

The single thallophyte represented by poorly preserved remains of a dichotomously branched thallus is of little botanical interest. The pteridophytes include a species referred to *Onoclea* and a *Lycopodium*, both represented by fruiting specimens. The cycadophytes, represented by a single species referred to *Podozamites*, are an insignificant element in the flora. TheConiferales are well represented. The Taxaceae are represented by *Cephalotaxus*-like fruits which are very common in the Black Creek beds of North Carolina and also occur in the upper Tuscaloosa beds of Alabama. The other member of this family is referred to the curious fernlike genus *Protophyllocladus*, a characteristic Upper Cretaceous type widely distributed in North America. The species is new but it has been recently detected by the writer in the Magothy formation of Maryland. The family Araucariaceae, so abundant in the Mesozoic, but antipodean in the existing flora, has three typical species in the South Carolina Cretaceous: one based on foliage, another on cone scales, and the third on seeds, possibly all representative of a single botanical species. The family Brachy-

phyllaceae is represented by the characteristic and widely distributed *Brachyphyllum macrocarpum* Newberry, the last survivor of an ancient Mesozoic line. The order Pinales is represented by a species of *Pinus* of modern aspect, by the characteristic remains of the widely distributed *Sequoia Reichenbachii* (Geinitz) Heer, by *Cunninghamites elegans* (Corda) Endlicher (?), and by the widespread *Moriconia americana* Berry. The subfamily Cupresseae is certainly represented by *Widdringtonites subtilis* Heer, based upon both foliage and obscure cones, the identification of which is rendered certain by abundant attached cones from the Tuscaloosa formation in western Alabama.

The Monocotyledones are represented by five species: a *Potamogeton*, an *Arundo*, a *Phragmites*, and a *Carex*, all aquatic or strongly mesophytic types, and by the fragmentary remains of a large palmettolike fan palm which is one of the earliest representatives of this family of plants. Turning to the Dicotyledones, we find the amentiferous families represented by nine species: a *Juglans*, two characteristic species of *Myrica*, four of *Salix*, and two of *Quercus*. The Urticales are one of the most abundant orders in the South Carolina Cretaceous, easily the most abundant in point of numbers of individual specimens. A single doubtful species is referred to the modern warm-temperate genus *Momisia*. The figs number five species, four of which are lanceolate-leaved species and the other a palmately veined form. The former are exceedingly abundant at a number of localities and show a marked tendency toward the development of characteristic "dripping points," which are wanting in these forms in the northern part of their range. This peculiarity is shared by a number of other genera belonging to this flora. The family Proteaceae, in the existing flora largely and almost exclusively developed in the southern hemisphere, is represented by two species of *Proteoides*, so called from their close affinity with the modern species of *Protea*.

The order Ranales, which at the present time has received such undue prominence through the phylogenetic speculations of Wieland, Arber, and others, is represented by six species: a *Dewalquea* of remarkable and striking appearance, which occurs also in the Tuscaloosa formation of Alabama, by a new species of

Illicium, and by four well-known species of *Magnolia*, two of which range northward as far as Greenland, and three of which range southward into Alabama.

There are five species of Rosales: a *Hamamelites*, two species of *Leguminosites*, a *Caesalpinia*, and an *Acacia*-like form. The order Geraniales, while poorly represented, contains two remarkable forms: a *Citrophyllum* very close to the modern genus *Citrus*, and *Crotonophyllum*, a genus allied to the modern genus *Croton* of the family Euphorbiaceae. *Crotonophyllum* is rather common in the Middendorf beds, the only other species of the genus occurring in the Cenomanian of Bohemia.

The order Sapindales is a large one represented by six species: a form doubtfully referred to the genus *Pachistima*, a *Sapindus*, a large *Rhus*, and by three species of *Celastrophyllum*, a genus abundant from toward the close of the Lower Cretaceous until the close of the Colorado. The order Thymeleales also includes six species: two well-known species of *Laurus*, two species of *Laurophyllum*, and two of *Cinnamomum*,—one the widespread **Cinnamomum Newberryi**,* and the other new. The Myrtales have three species of *Eucalyptus*, the order Umbellales is represented by a single infrequent species of *Hedera*, and the Ericales by four species of *Andromeda*, one of which is new. The Primulales are represented by a single rather widespread species of *Myrsine*, and the Ebenales by two species of *Diospyros*.

This flora, of which a brief abstract has just been given, serves to indicate certain physical conditions which prevailed at the time it flourished. Abundantly confirmed by the character of the deposits, it indicates a considerable elevation and relief of the Piedmont area of South Carolina with numerous streams of a considerable gradient. While no precise results regarding the climate are possible, it is safe to assume that it was mild and uniform though not necessarily tropical. We may confidently assert that frosts were unknown. The climate was humid, the presence of numerous coriaceous-leaved forms being due to insolation or exposure to winds, especially along the strand, and to a swamp

* This is a new name for the well-known species *Cinnamomum intermedium* of Newberry, the name *intermedium* having been previously used by Baron Ettingshausen.

habitat in other cases. That the rainfall was plentiful may be inferred not only from the grouping of the plants but from the development of dripping points. In a previous number of the BULLETIN, in a brief discussion of the Cretaceous flora of Georgia, the latter was compared with the modern temperate rain forest of New Zealand, for a discussion of which the reader is referred to Schimper's Plant Geography. While this resemblance of the New Zealand flora to that of the Upper Cretaceous of the Atlantic coastal plain is of a most general nature, the former offers the nearest approach among modern plant assemblages to the Upper Cretaceous flora of the Atlantic coastal plain, a fact emphasized by a consideration of this Upper Cretaceous flora as developed in South Carolina. This flora will be fully described and illustrated in a publication of the U. S. Geological Survey, now in press. The work was prosecuted under the supervision of Dr. T. Wayland Vaughan of that organization, to whom I am indebted for permission to publish the foregoing brief abstract.

JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MD.

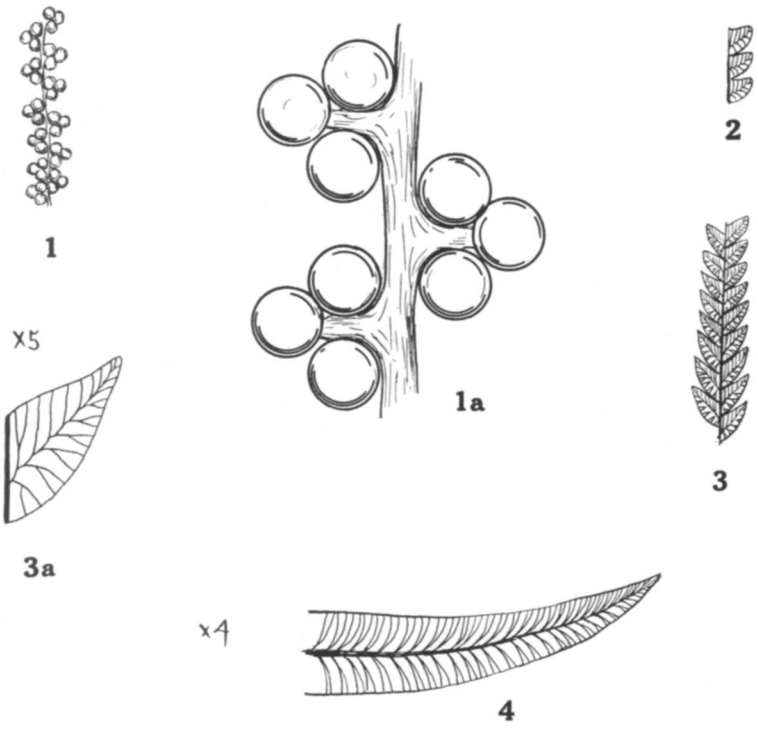
Explanation of plates 18 and 19

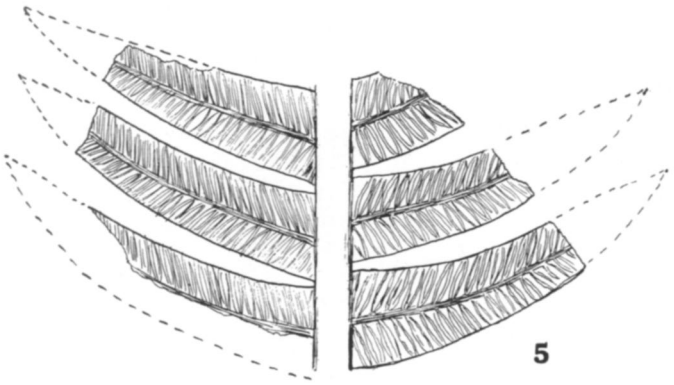
PLATE 18

FIG. 1. *Onoclea inquirenda* Hollick. Magothy formation, Severn River, Md.
FIG. 1a. Part of the foregoing, ×6.
FIG. 2, 3. *Gleichenia Saundersii* Berry. Magothy formation, Severn River, Md.
FIG. 3a. Pinnule of the foregoing, ×5.
FIG. 4, 5. *Asplenium cecilensis* Berry. Magothy formation, Grove Point, Md.

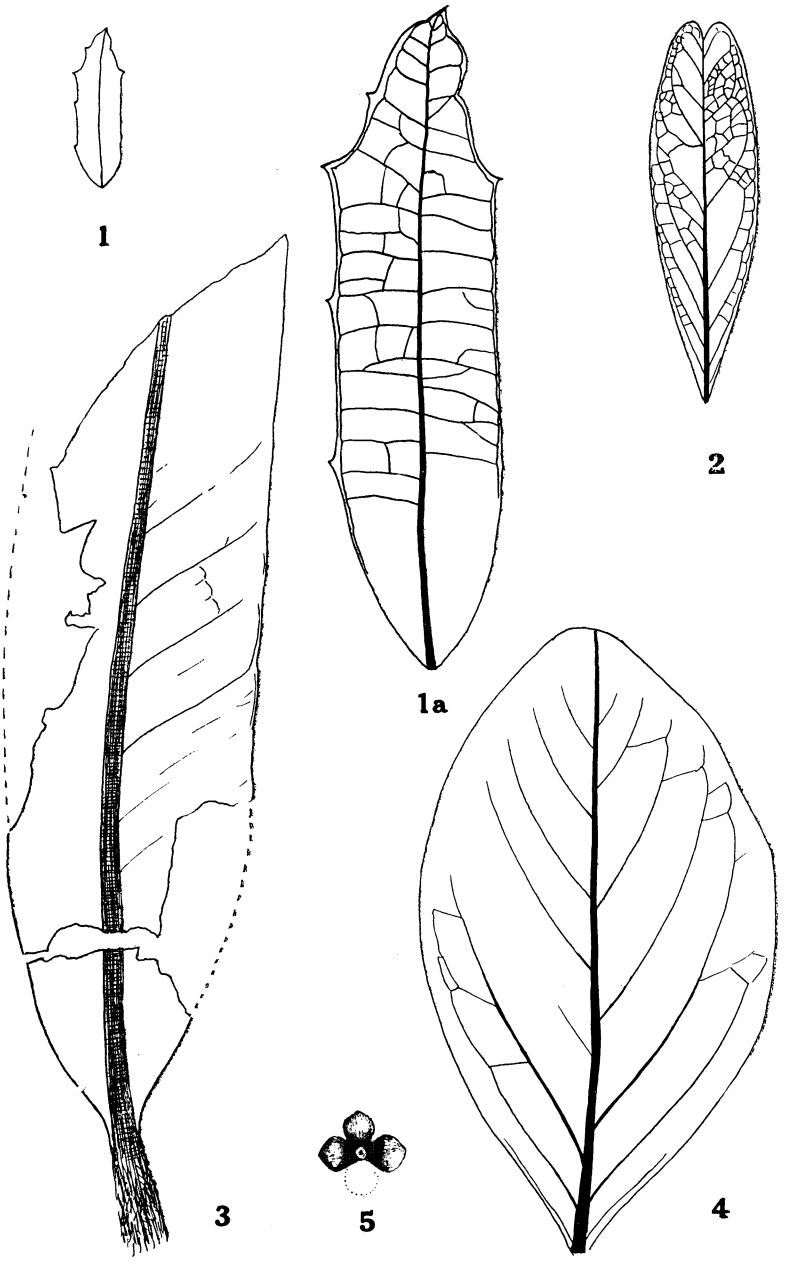
PLATE 19

FIG. 1. *Ilex severnensis* Berry. Magothy formation, Little Round Bay, Md.
FIG. 1a. The same, ×4.
FIG. 2. *Dalbergia severnensis* Berry. Magothy formation, Little Round Bay, Md.
FIG. 3. *Ficus matawanensis* Berry. Matawan formation, Lorillard, N. J.
FIG. 4. *Cornus cecilensis* Berry. Magothy formation, Grove Point, Md.
FIG. 5. *Diospyros vera* Berry. Raritan formation, East Washington Heights, D. C.





UPPER CRETACEOUS FILICALES



UPPER CRETACEOUS DICOTYLEDONES